A management strategy evaluation of Pacific hake: scenarios and results

Nis S. Jacobsen, Aaron M. Berger, Kristin N. Marshall, Ian G. Taylor

Scenarios

- 5 different scenarios through the full MSE

    1. Catch scenarios

    2. Movement scenarios (not shown)

    3. Selectivity scenarios

    4. Climate change (movement increases over time)

    5. Survey frequency scenarios

Management objectives identified by MSE working group

Coastwide objectives

- Minimize risk of severe overfishing and closing the fishery

- Minimize the risk of spawning biomass dropping below the specified management target for >3 years

- Avoid closing the fishery

- Avoid high variability in total catches

- Given above, maintain high average coast wide catch

Spatial objectives

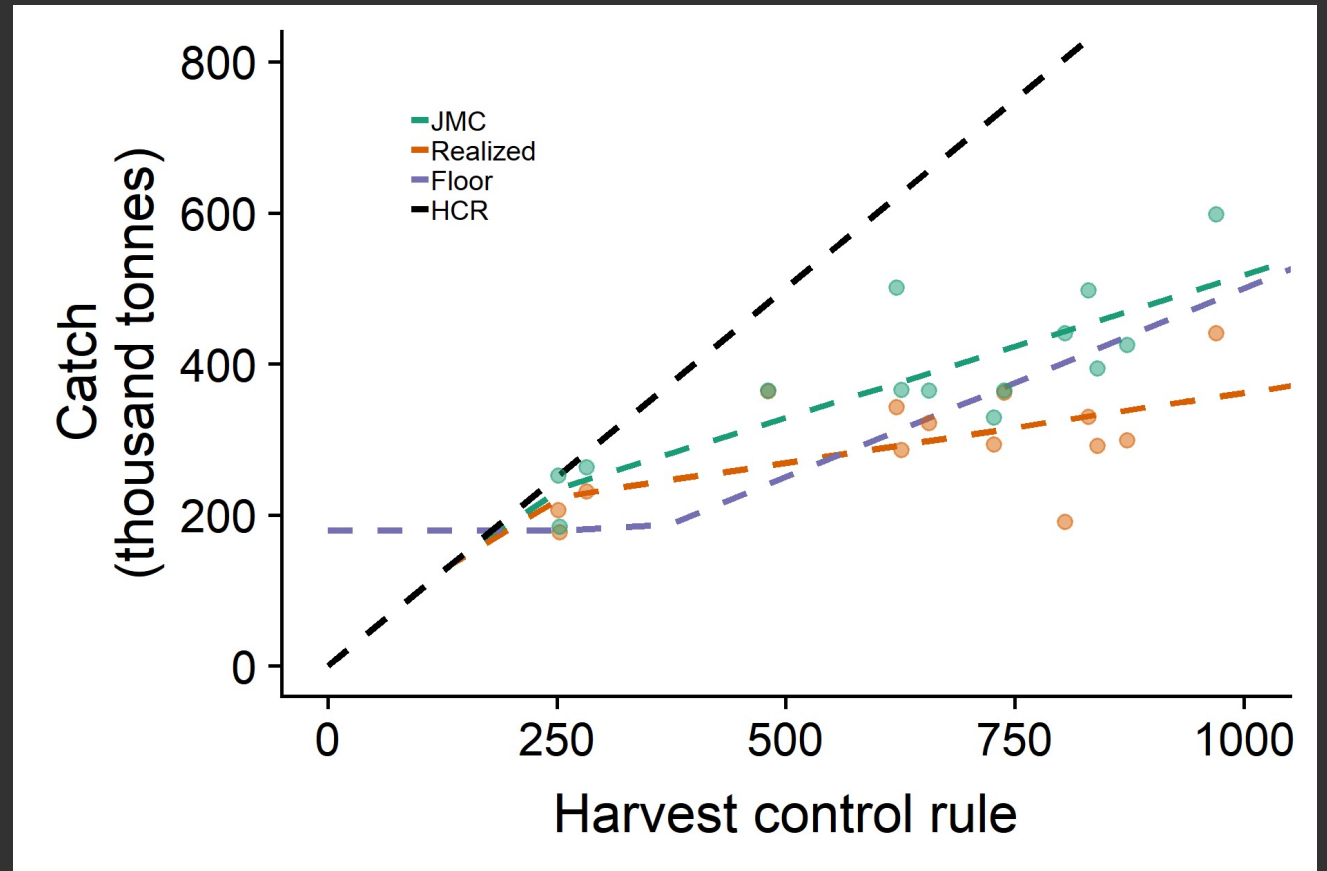- Maintain enough biomass to allow TAC to be attained in both countries
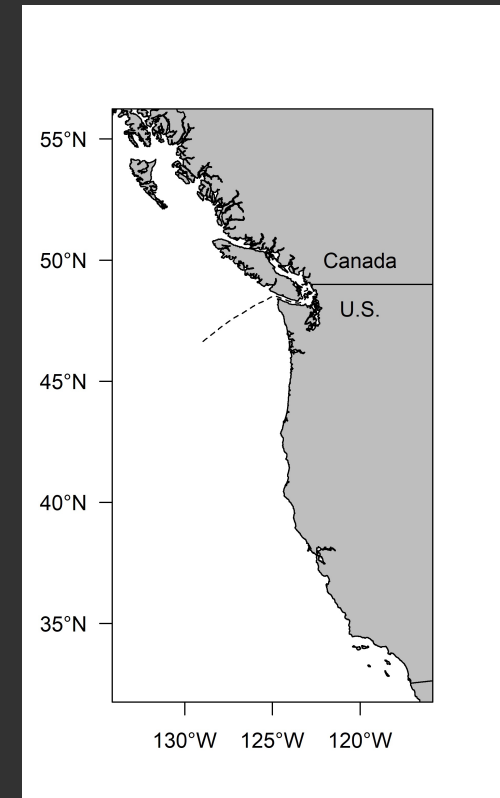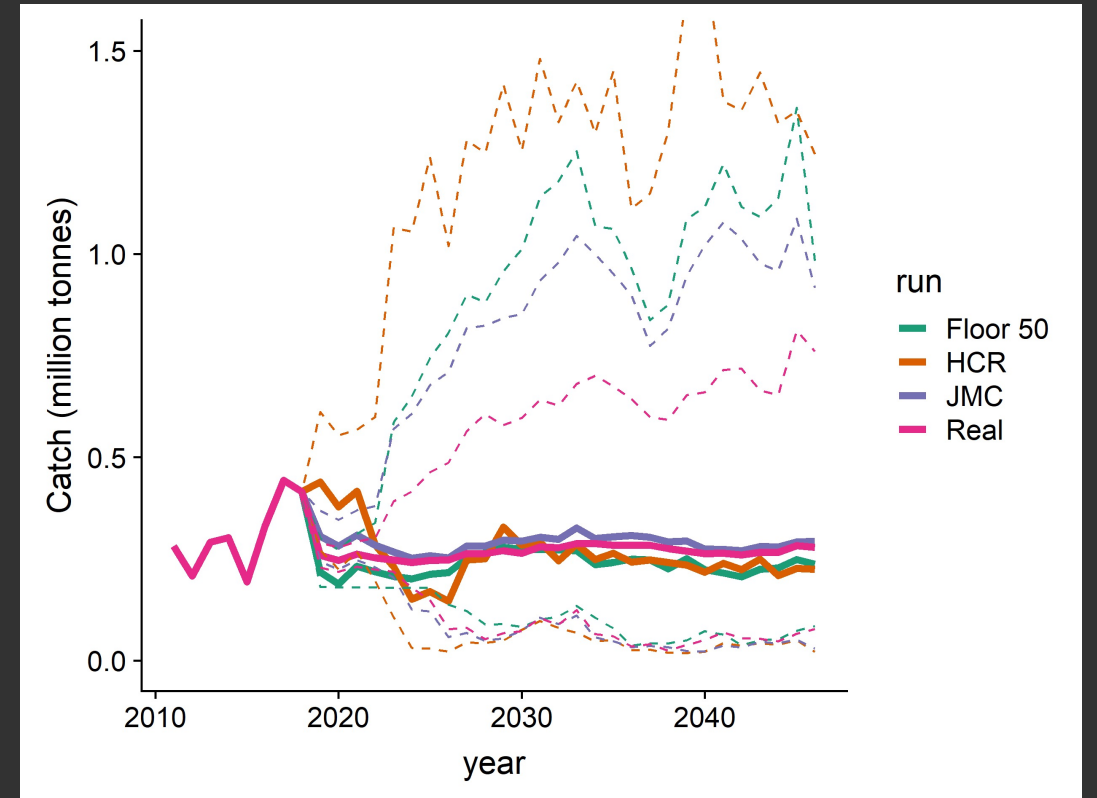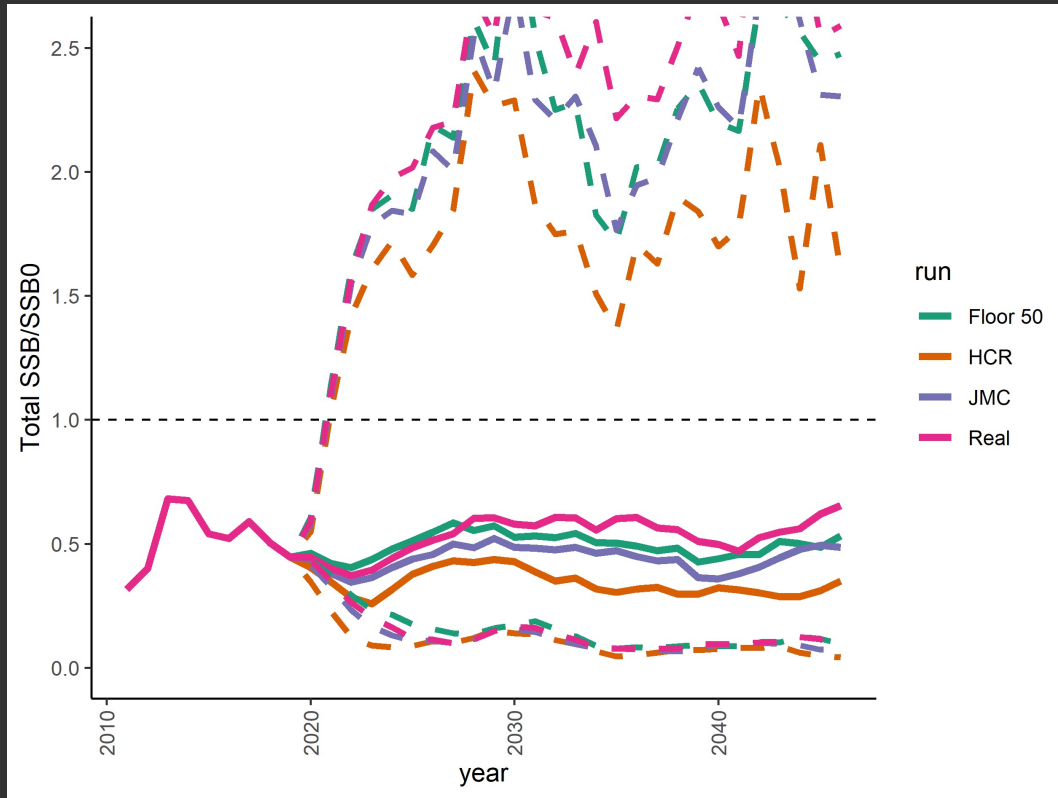
How are the data presented
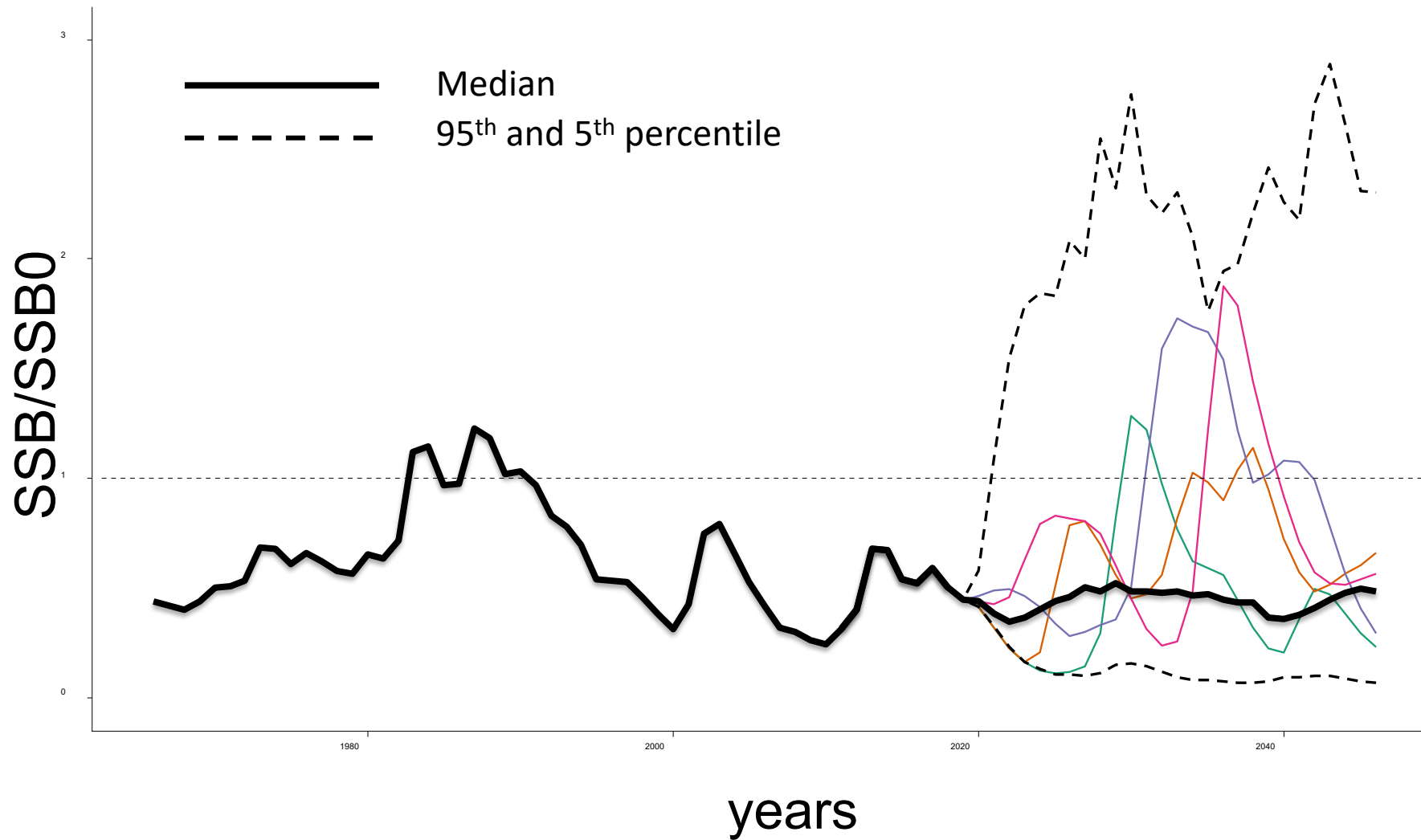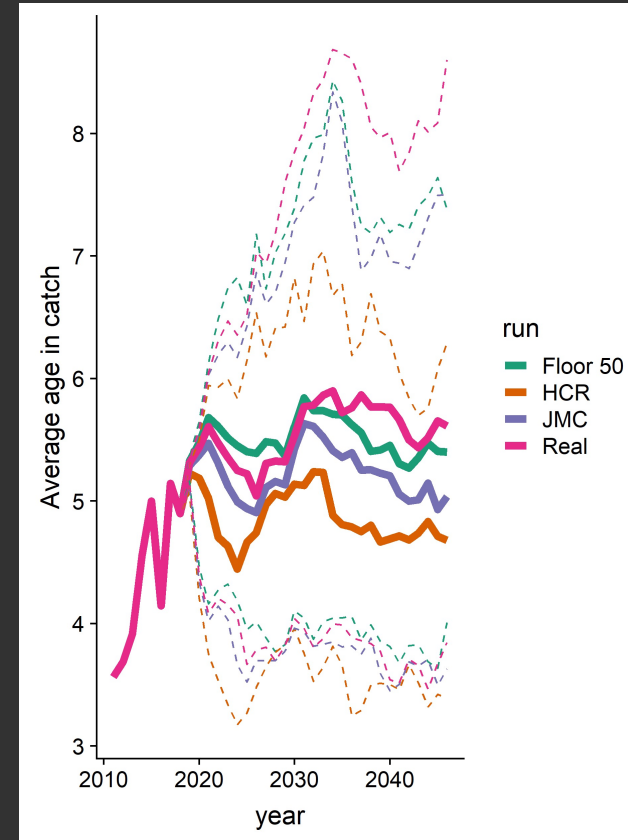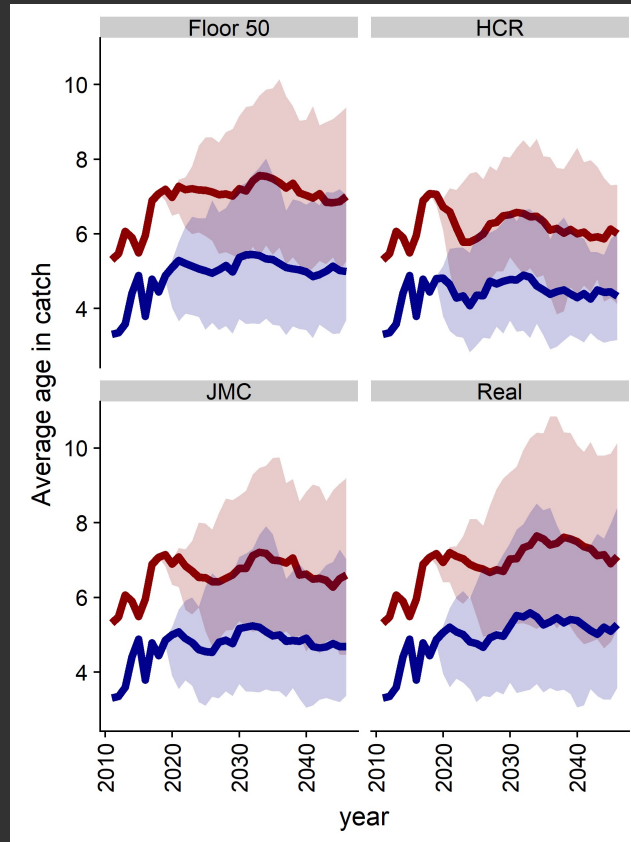
CATCH SCENARIOS

Catch scenarios

- Standard HCR

- Catch adjusted by historical JMC recommendation

- Catch adjusted by historical realized catch

- 50% HCR, but with a floor of 180000tonnes
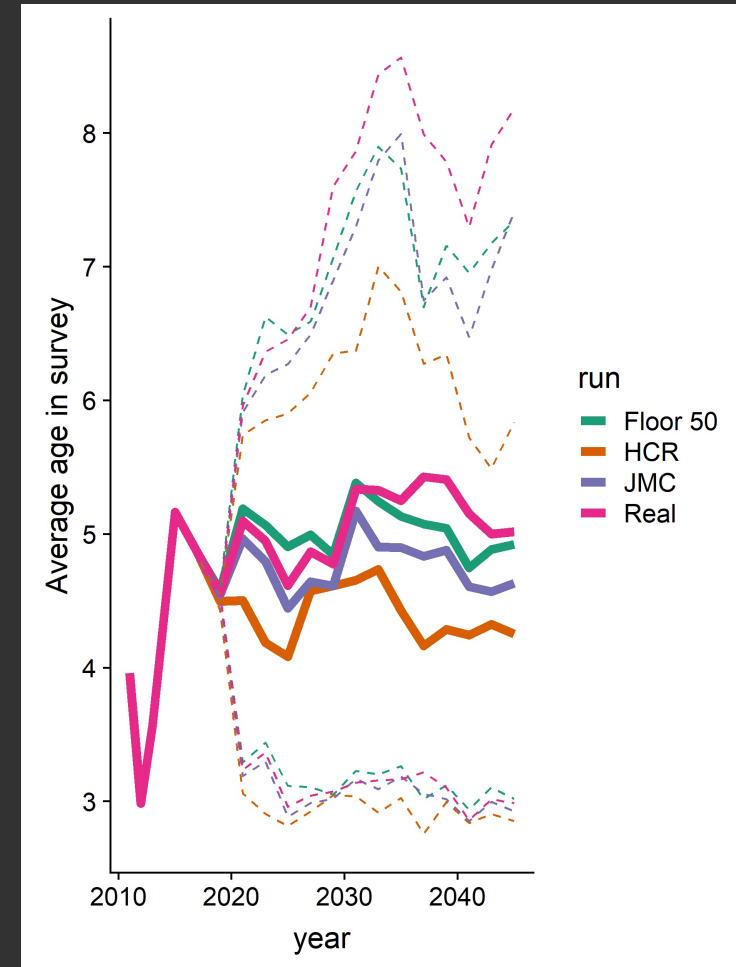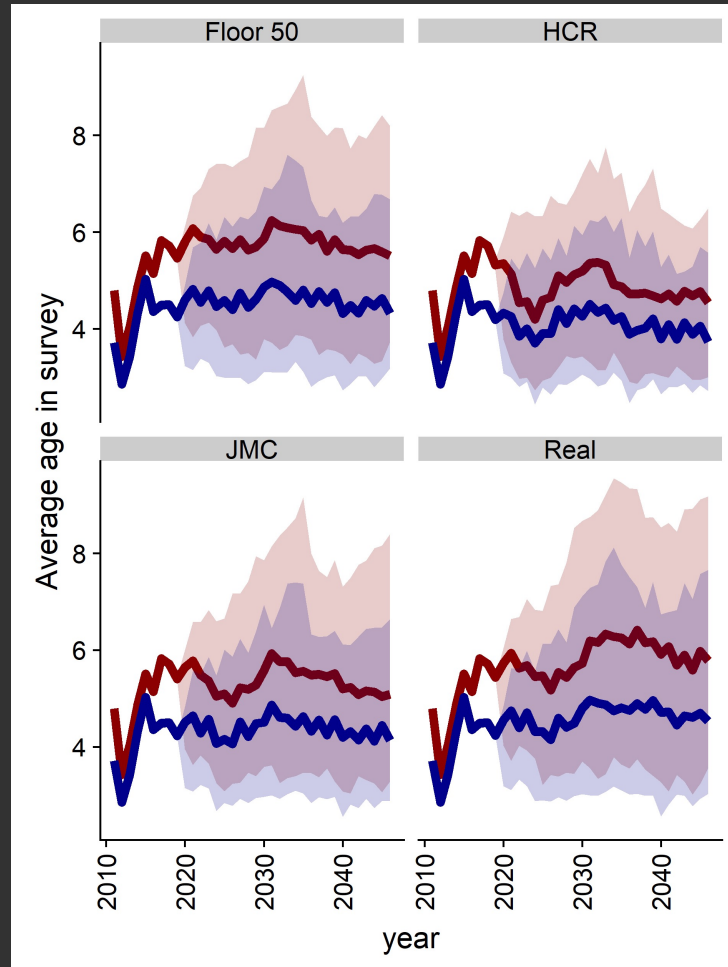
Total catches and biomass
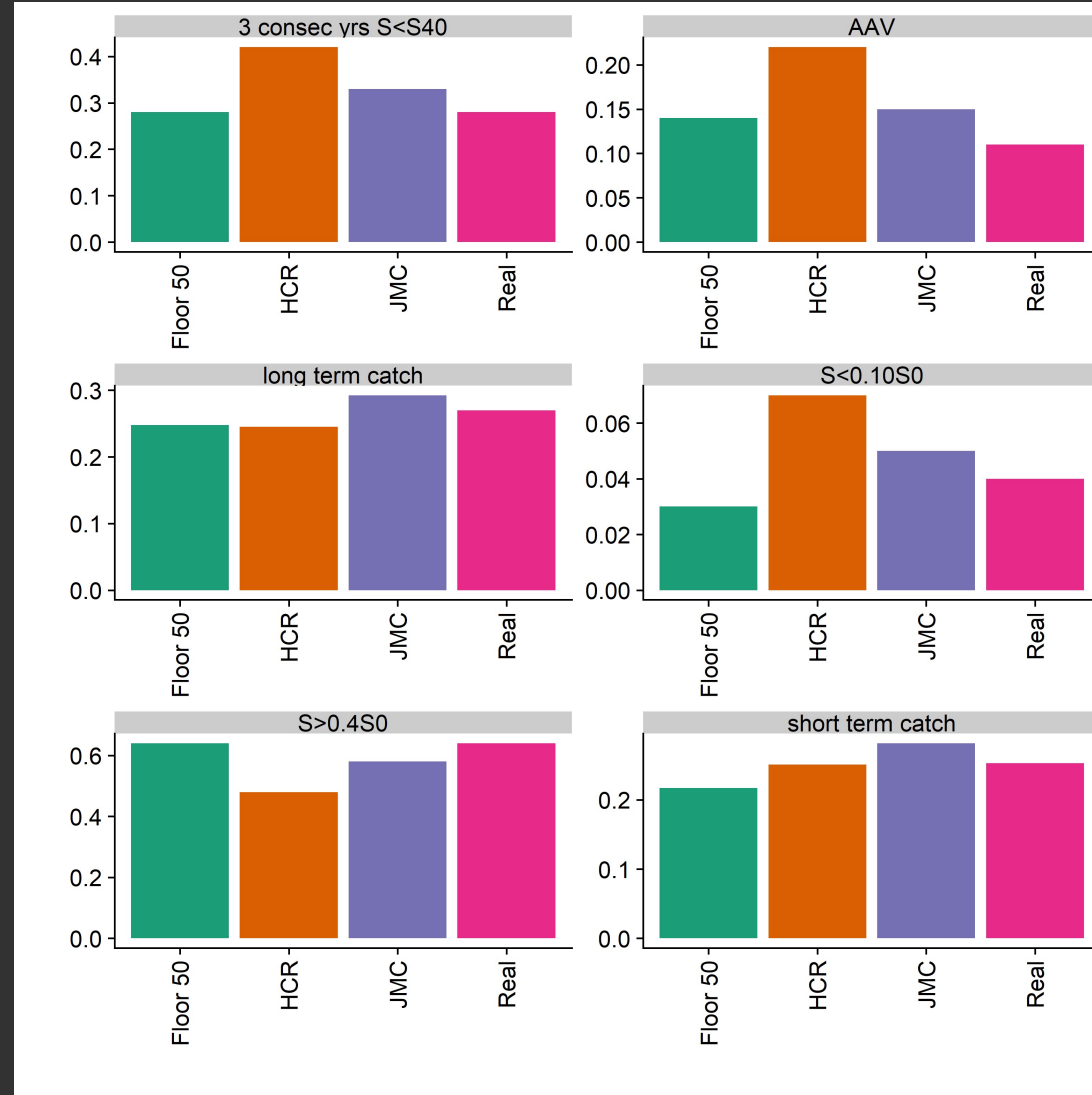
Age composition in the catch

Age composition between the countries

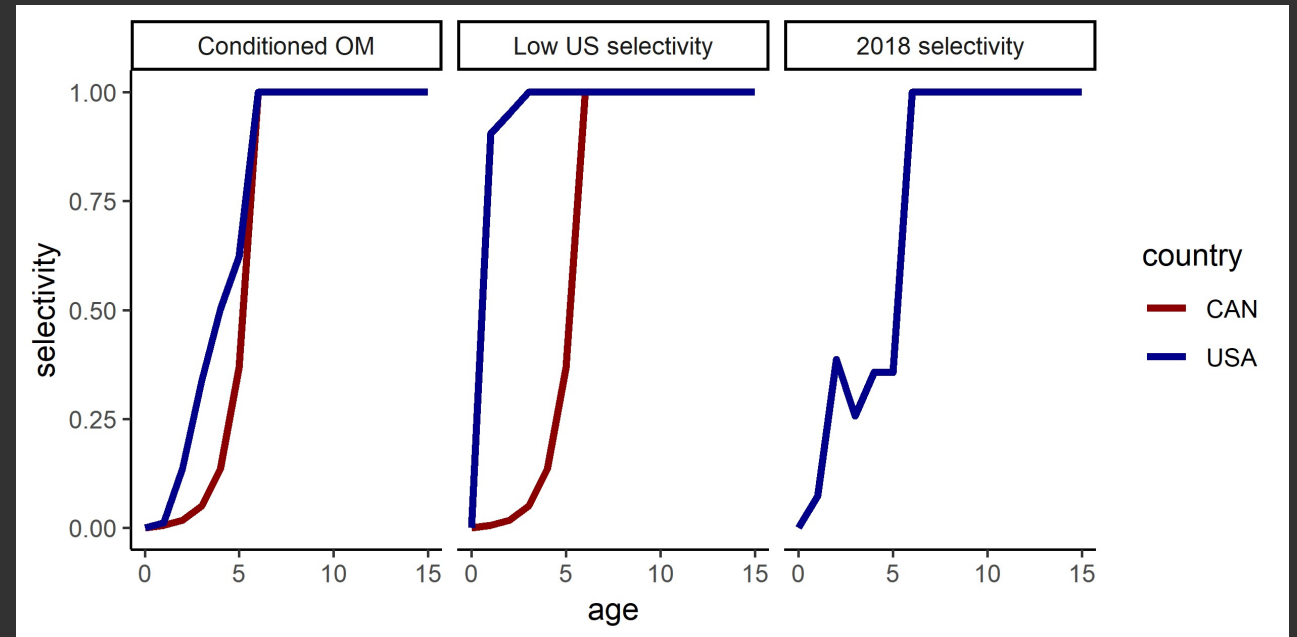# Performance metrics for catch scenarios

Catch scenarios conclusions

- The standard HCR performs worse than the realized and JMC scenarios in almost all cases

- It provides both lower catch and worse status of the stock

- Half of the HCR with a floor of 180k performs similar to the realized catch scenario
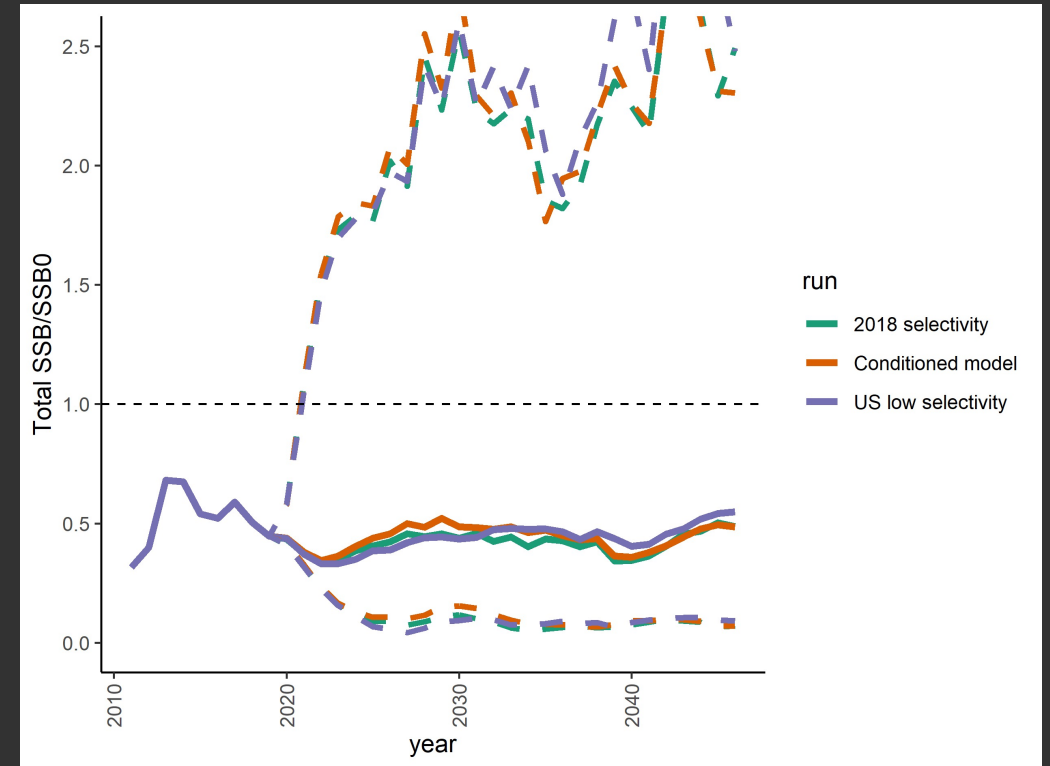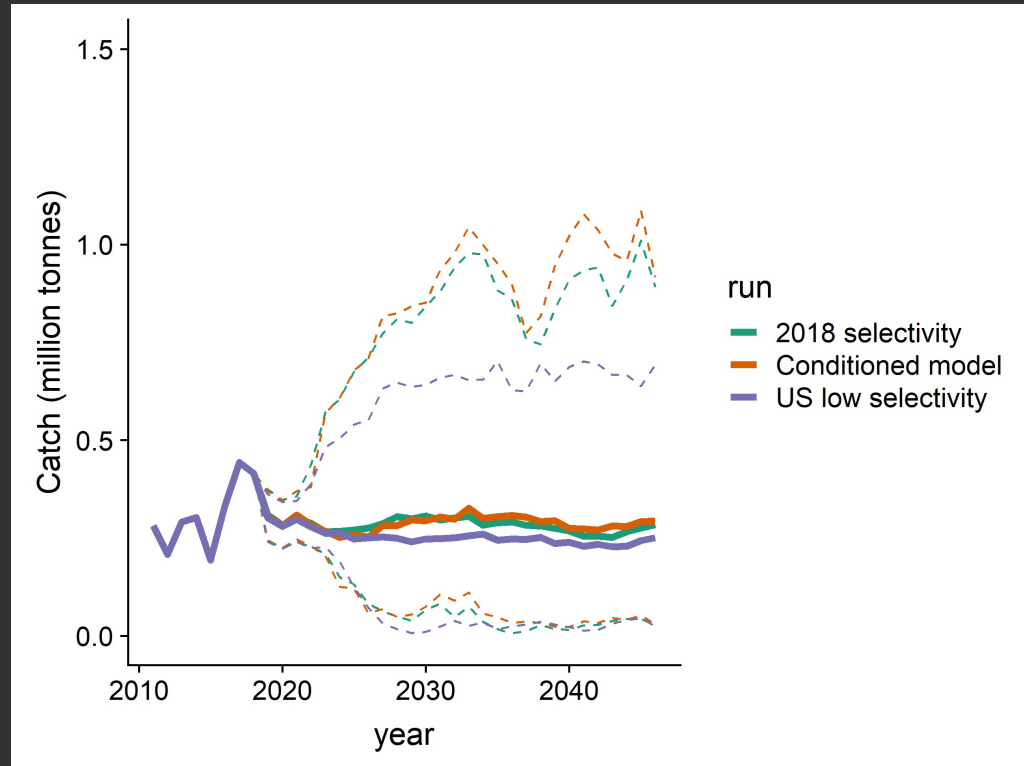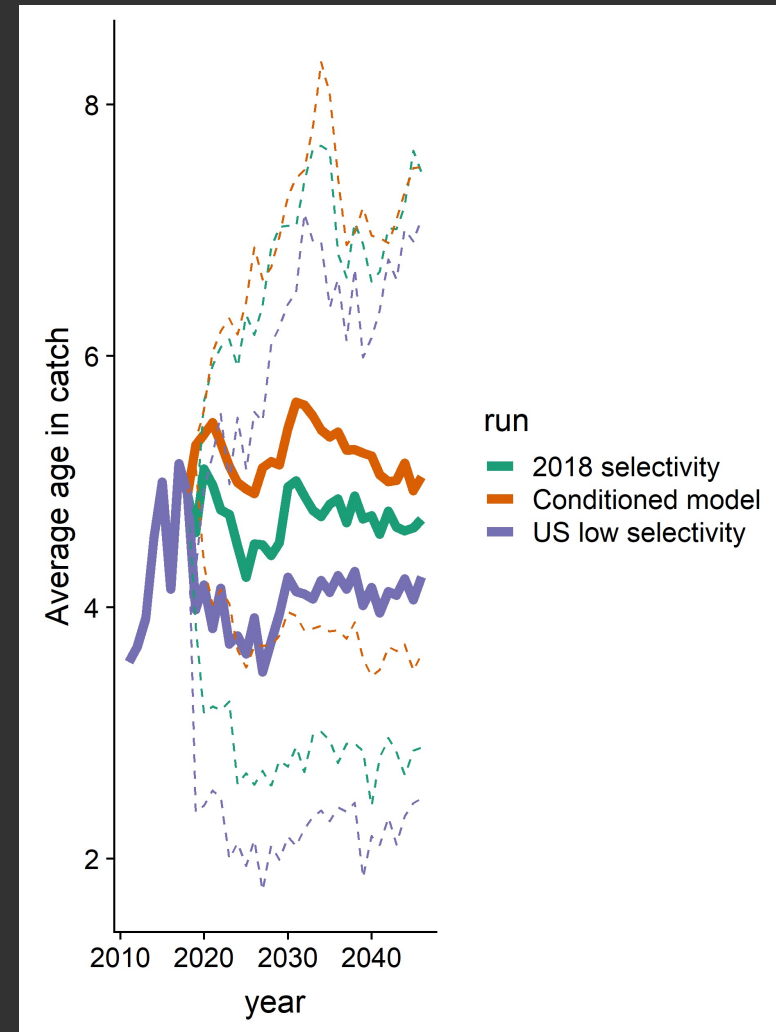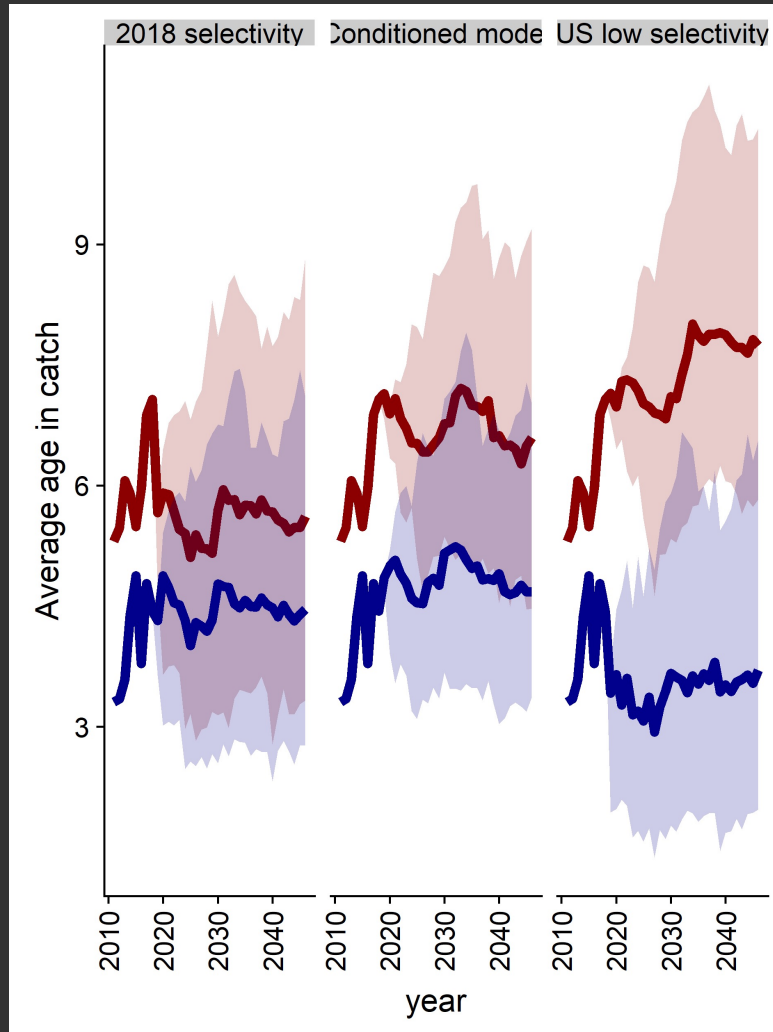
SELECTIVITY

Selectivity

- 3 selectivities (constant in time)
1. The selectivity from the conditioned operating model

2. US targets small fish – Canada has the same as in the conditioned operating model

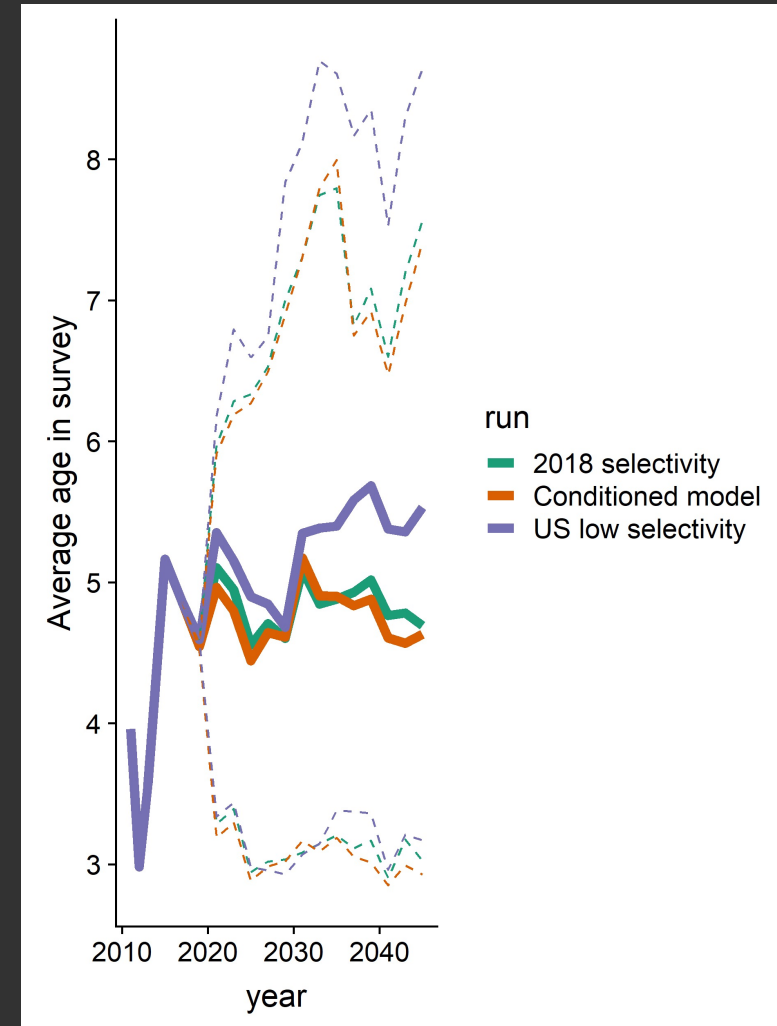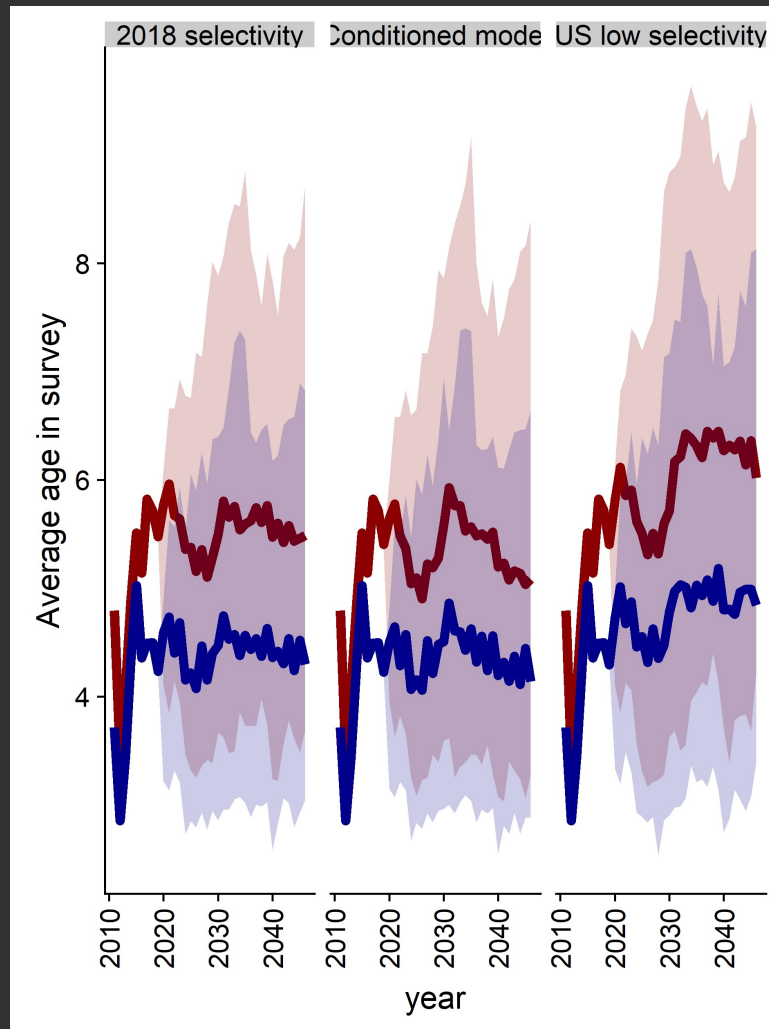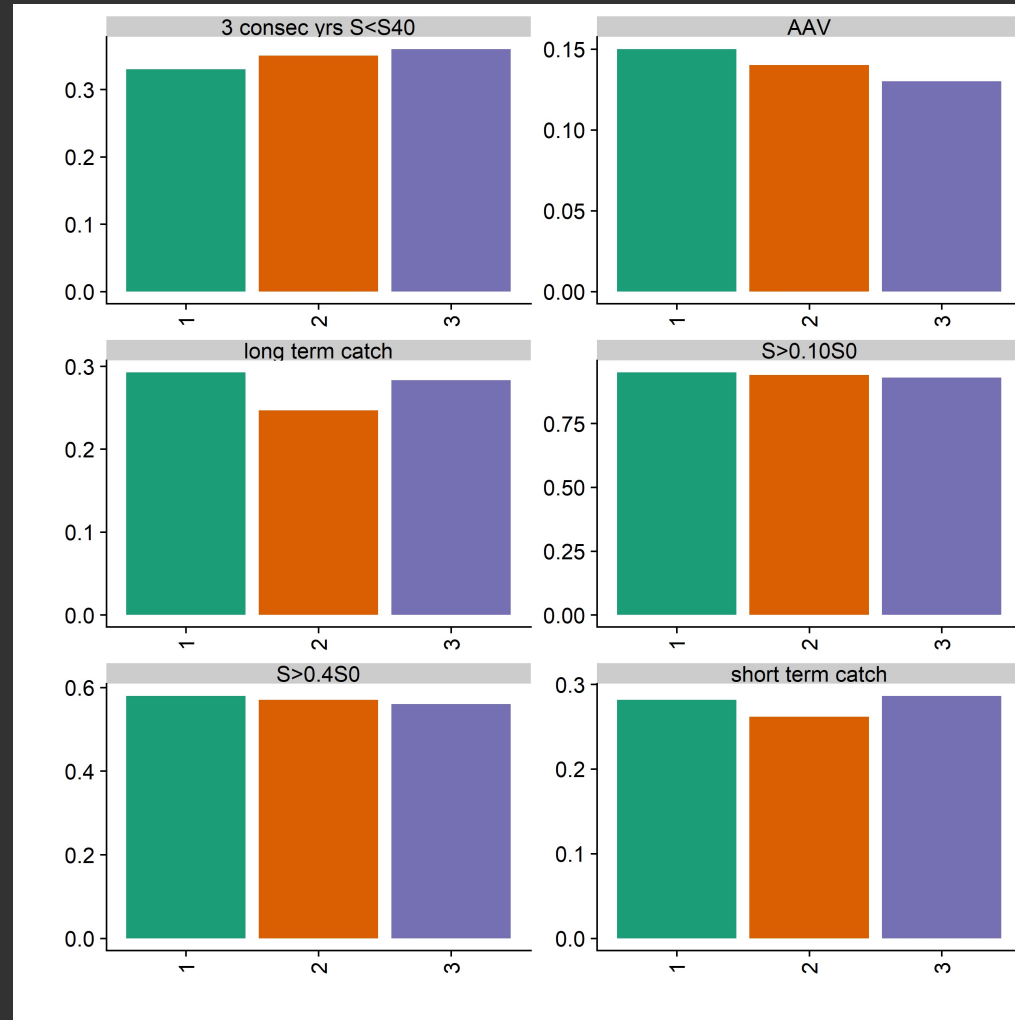3. Selectivity is the same in the two countries

Catch

Age compositions

Average age in the stock

Performance metrics for selectivity scenarios

1) Conditioned model

2) US low selectivity

3) 2018 selectivity
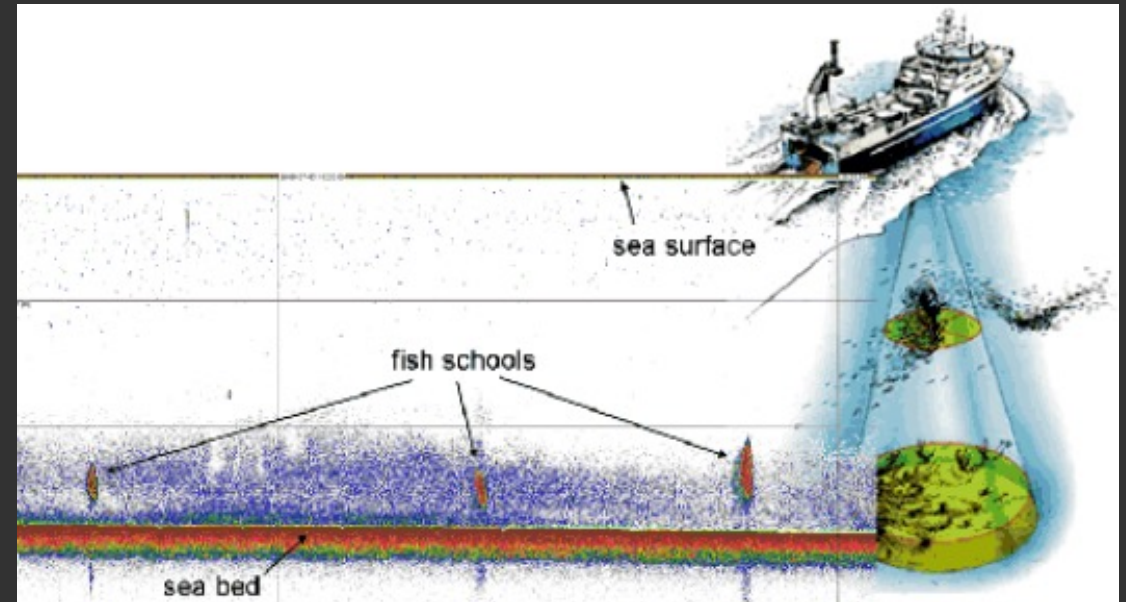
Selectivity scenarios conclusions

- Targeting more small fish in the US does not cause major disruption to the stock

- When the fishery targets small fish in the US, a higher number of older fish move into Canada

- 2018 selectivity overall provides a worse outlook for the stock than the US targeting small fish

SURVEY FREQUENCY
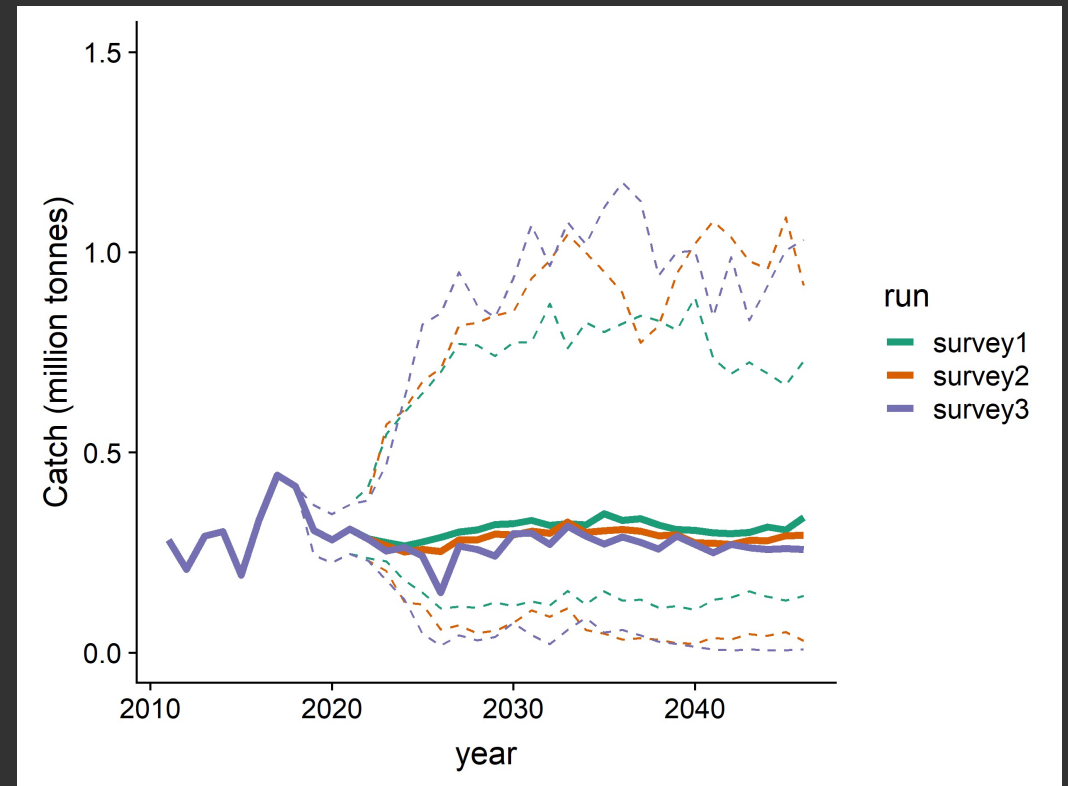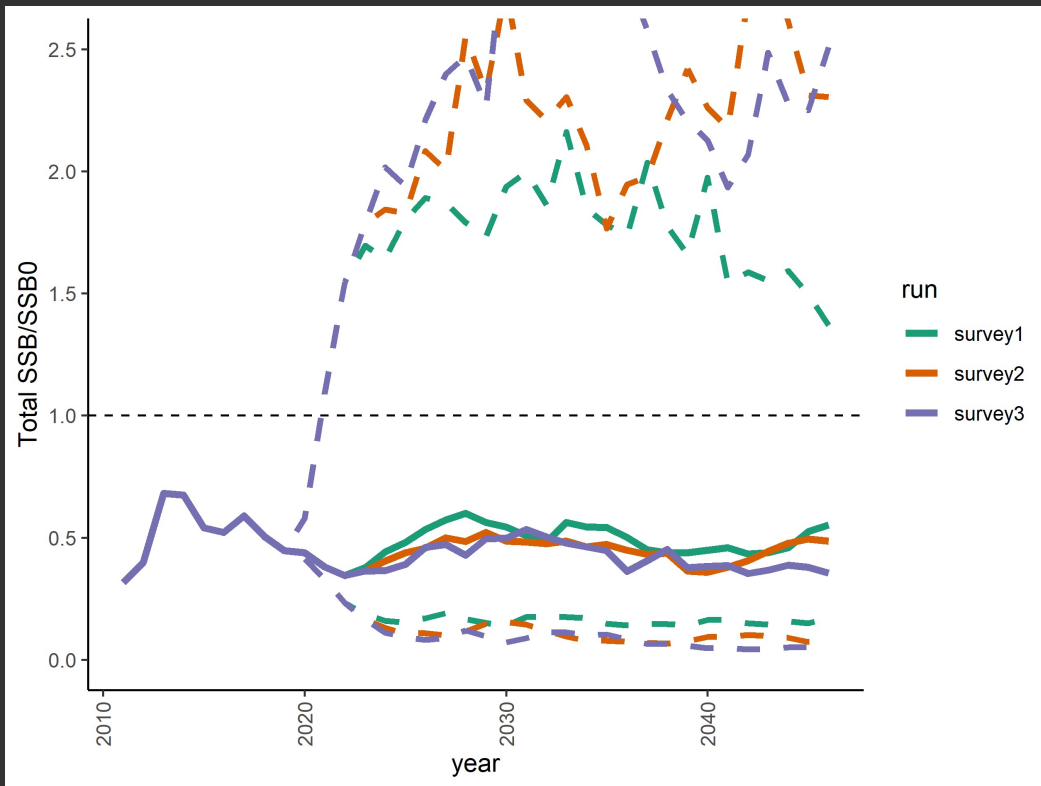
Survey frequency

- Three survey configurations

1. Survey every year

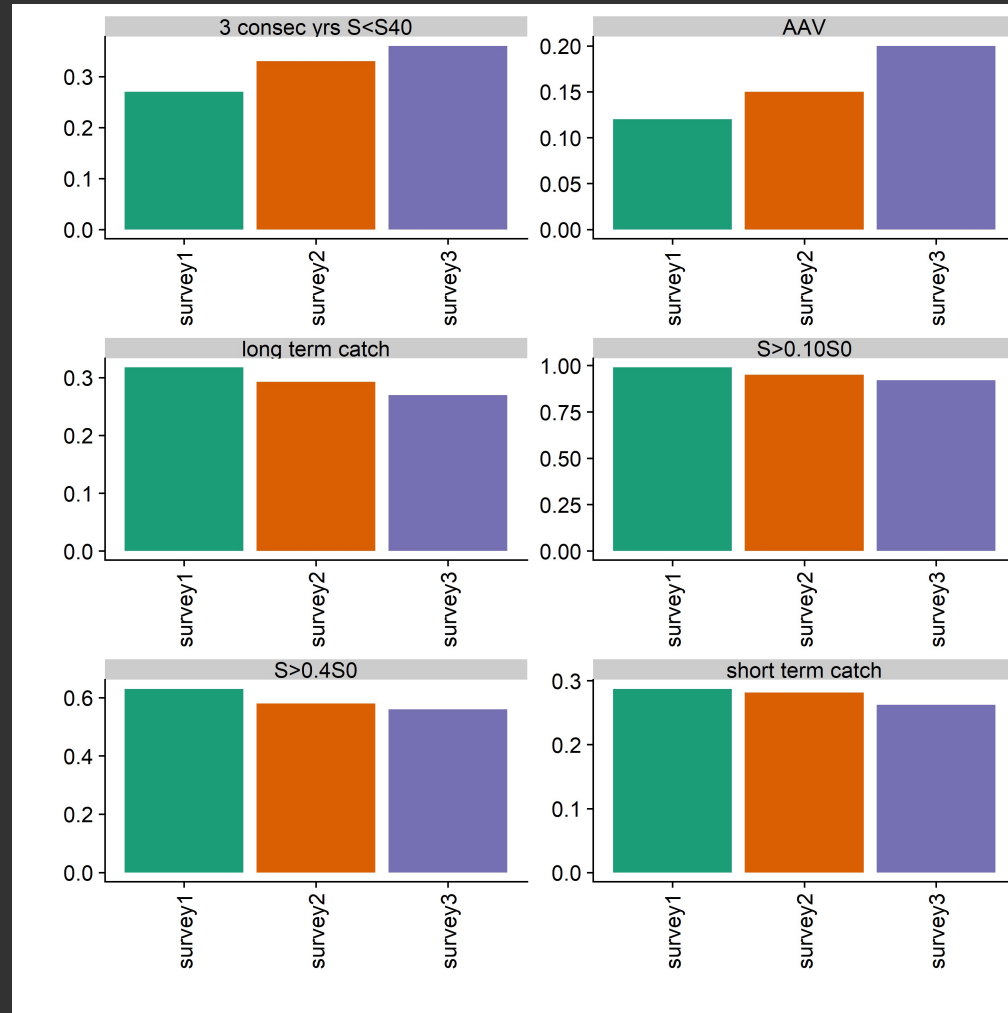2. Survey every second year

3. Survey every third year

Survey measures biomass abundance, and age compositions.

Catch

Performance metrics for survey scenarios

1) Annual survey

2) Biannual (baseline)

3) Triennial

Survey scenarios conclusions

- More frequent surveys perform better than less frequent

- Having a survey only every third year increased the catch variability, and years with closed fishery.

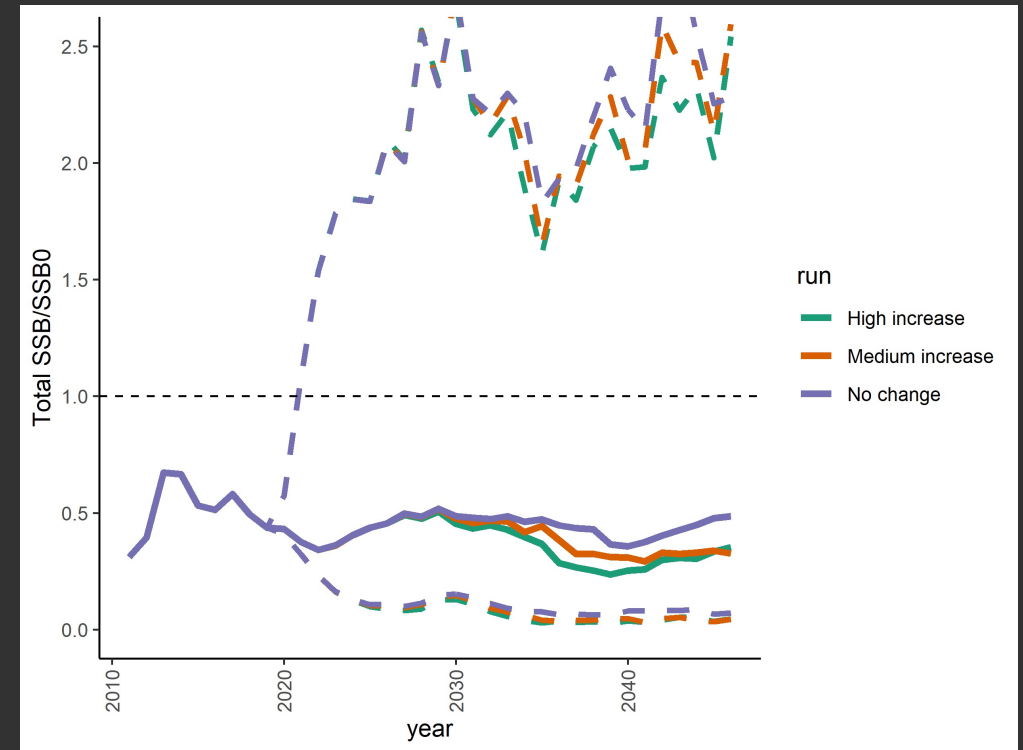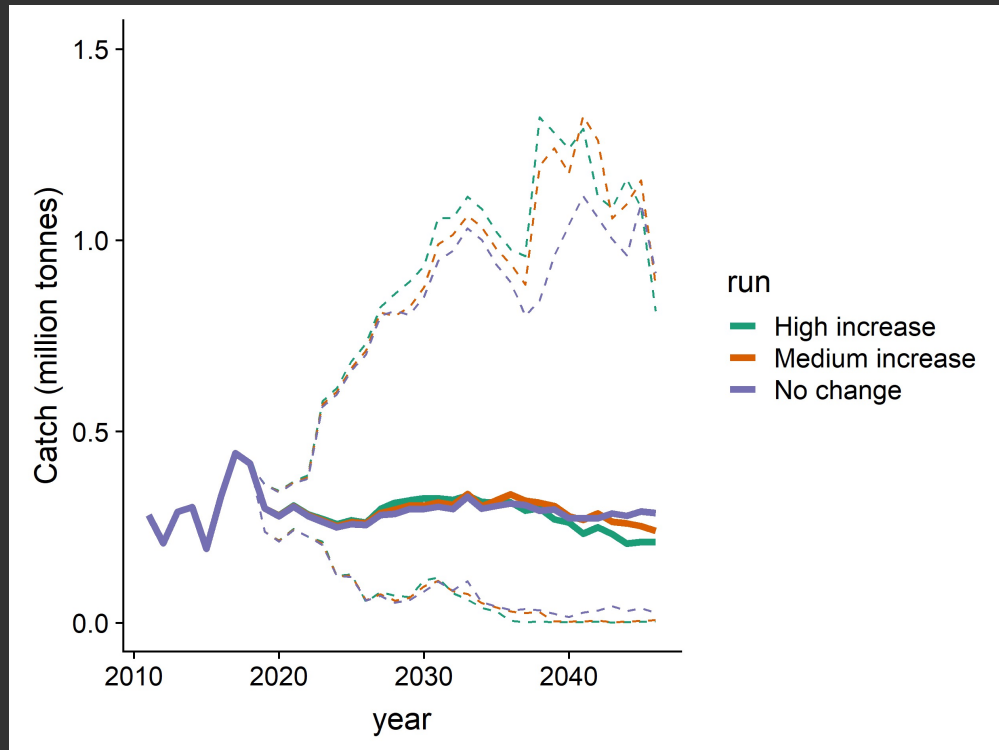- Total catches and spawning biomass were lower with less frequent surveys

CLIMATE SCENARIOS
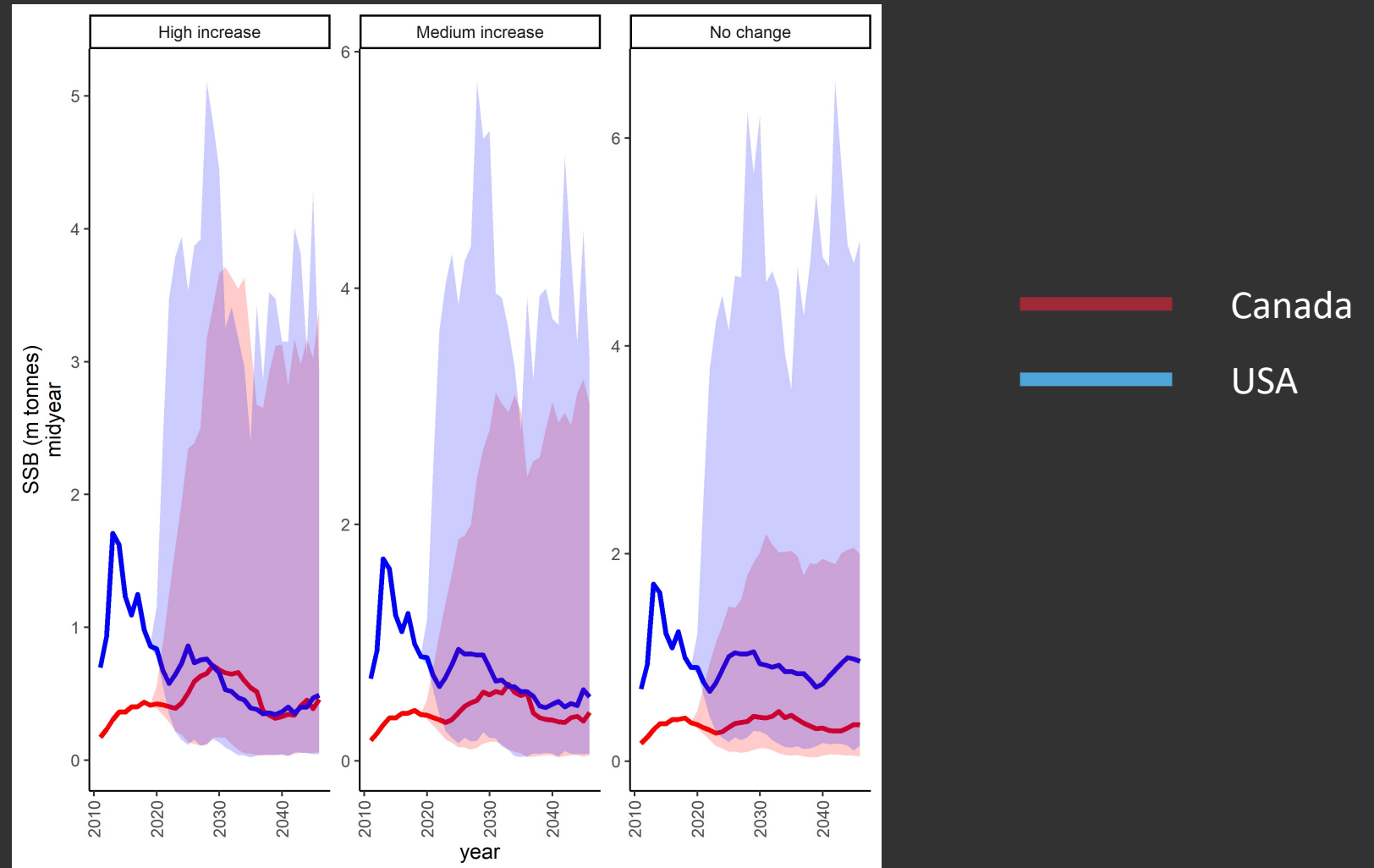
How climate change could affect movement?

- The maximum movement rate of fish increase over time
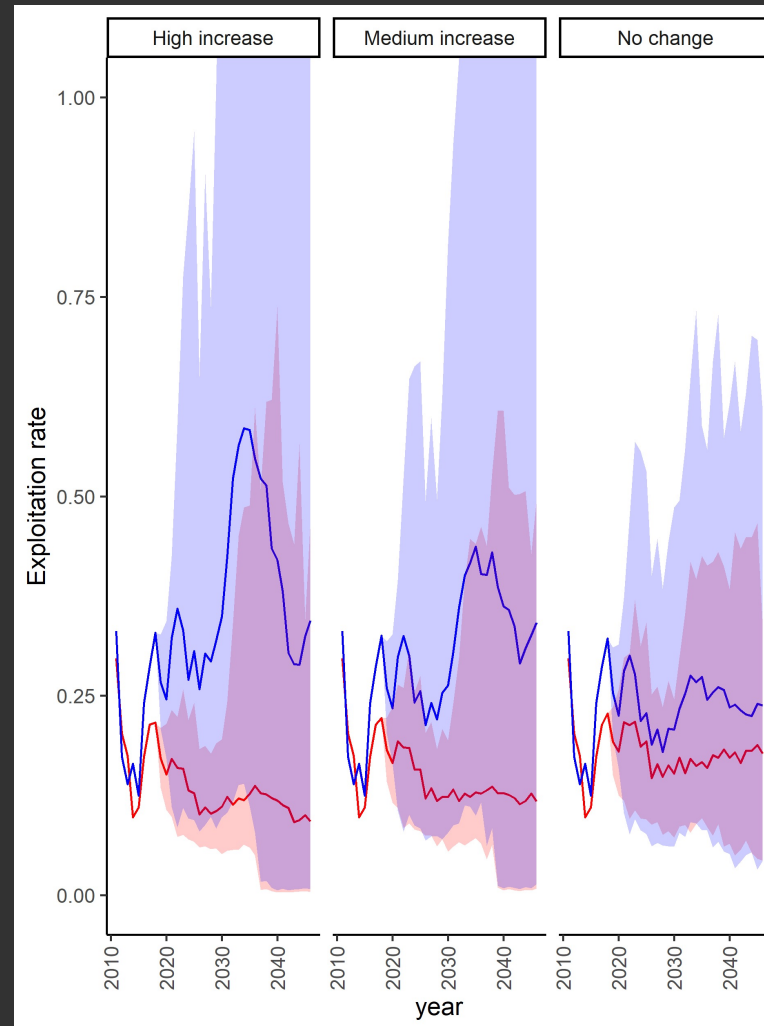
- The number of spawners returning south decreases
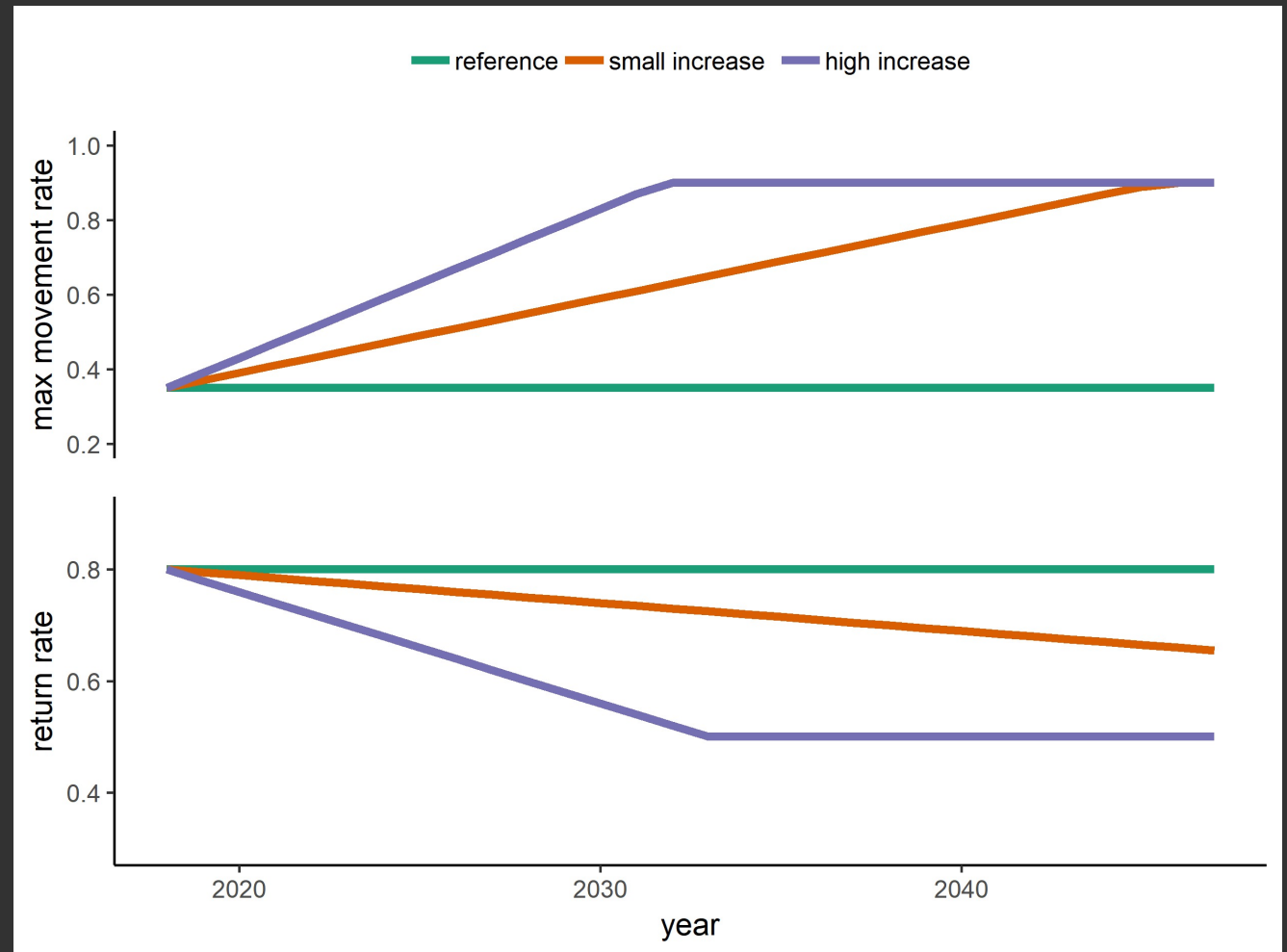
Climate scenarios
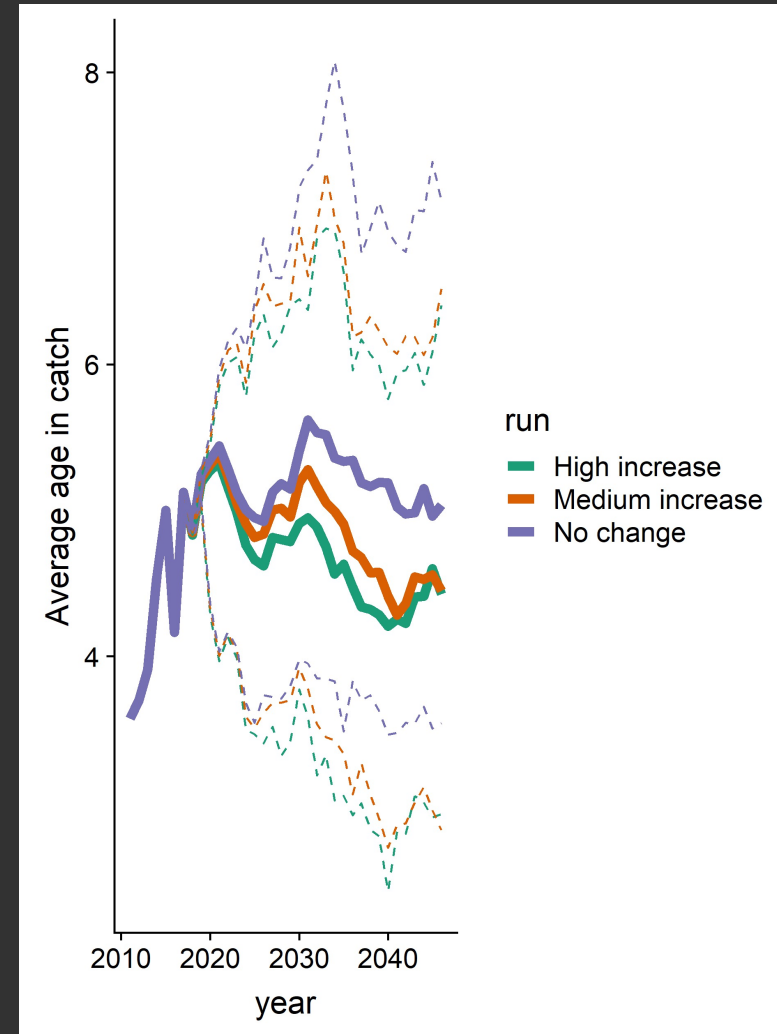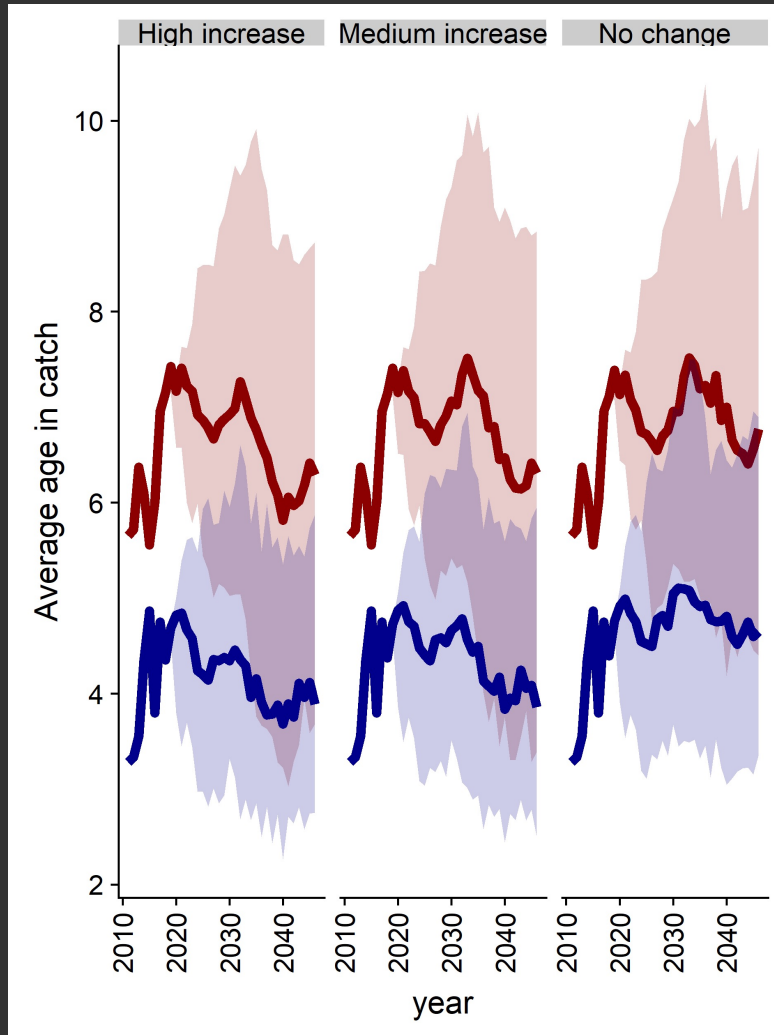
Spawning biomass distribution under climate change

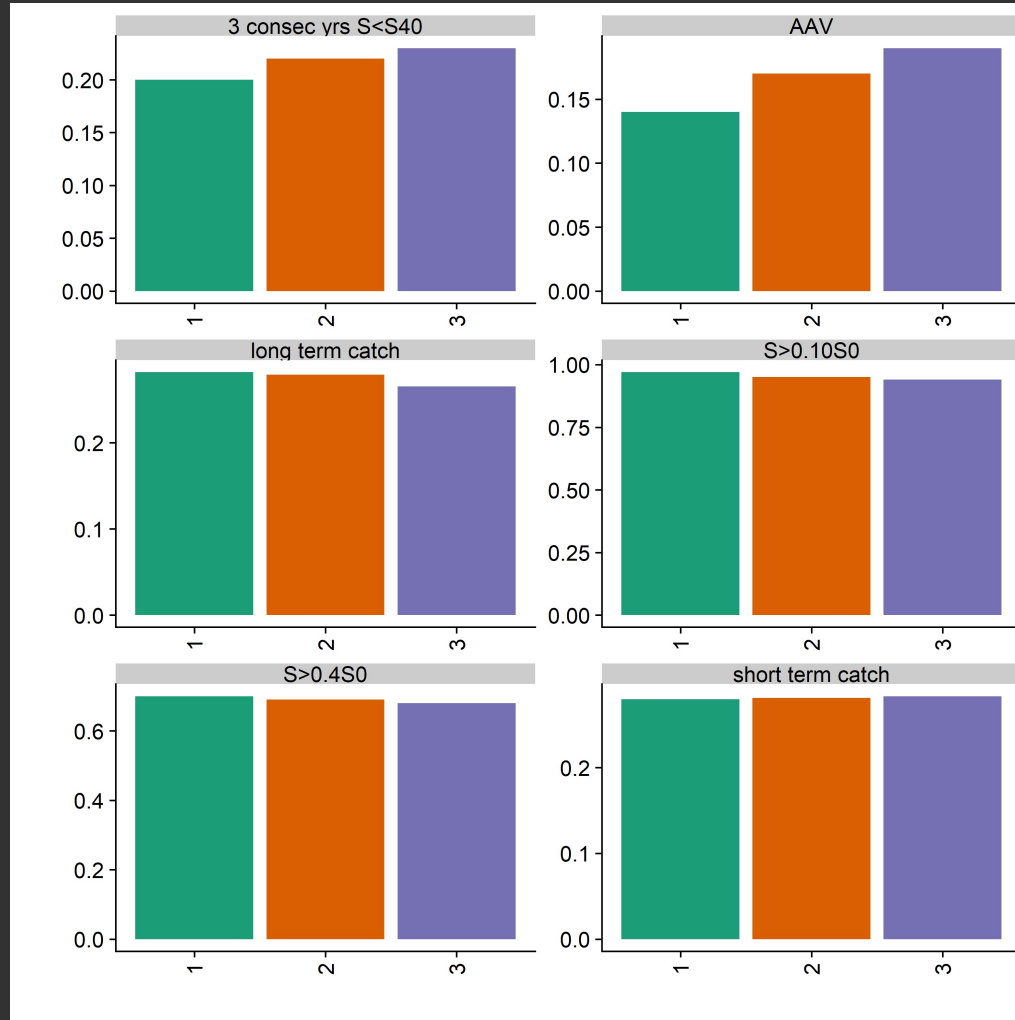# Fishing mortality under climate change

Age compositions

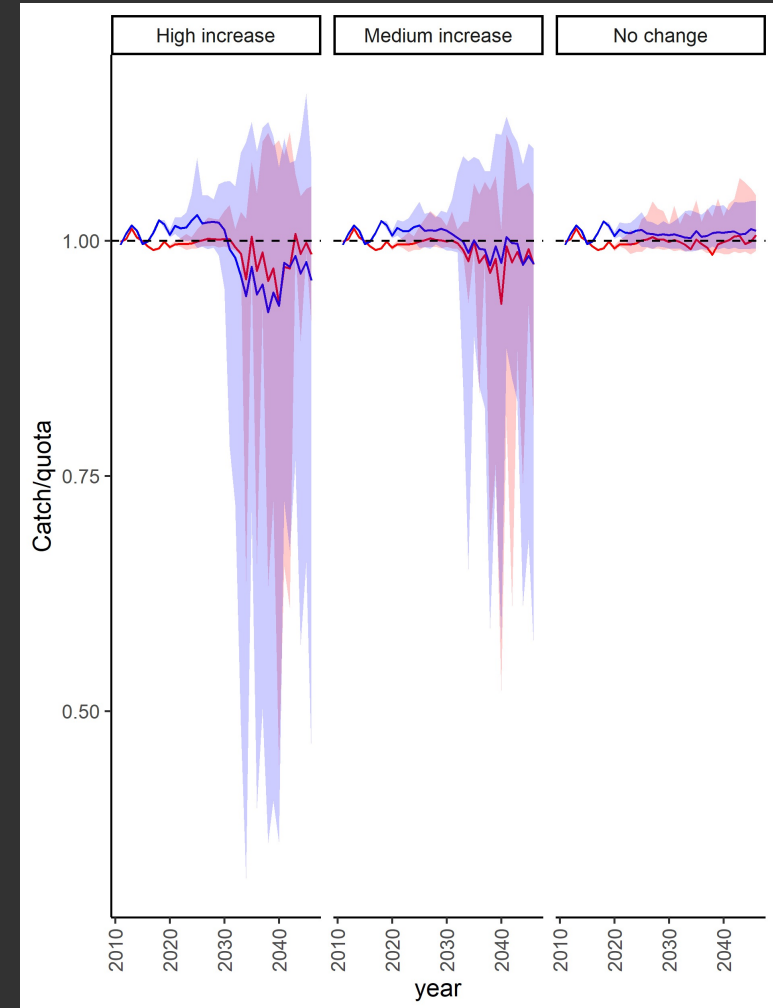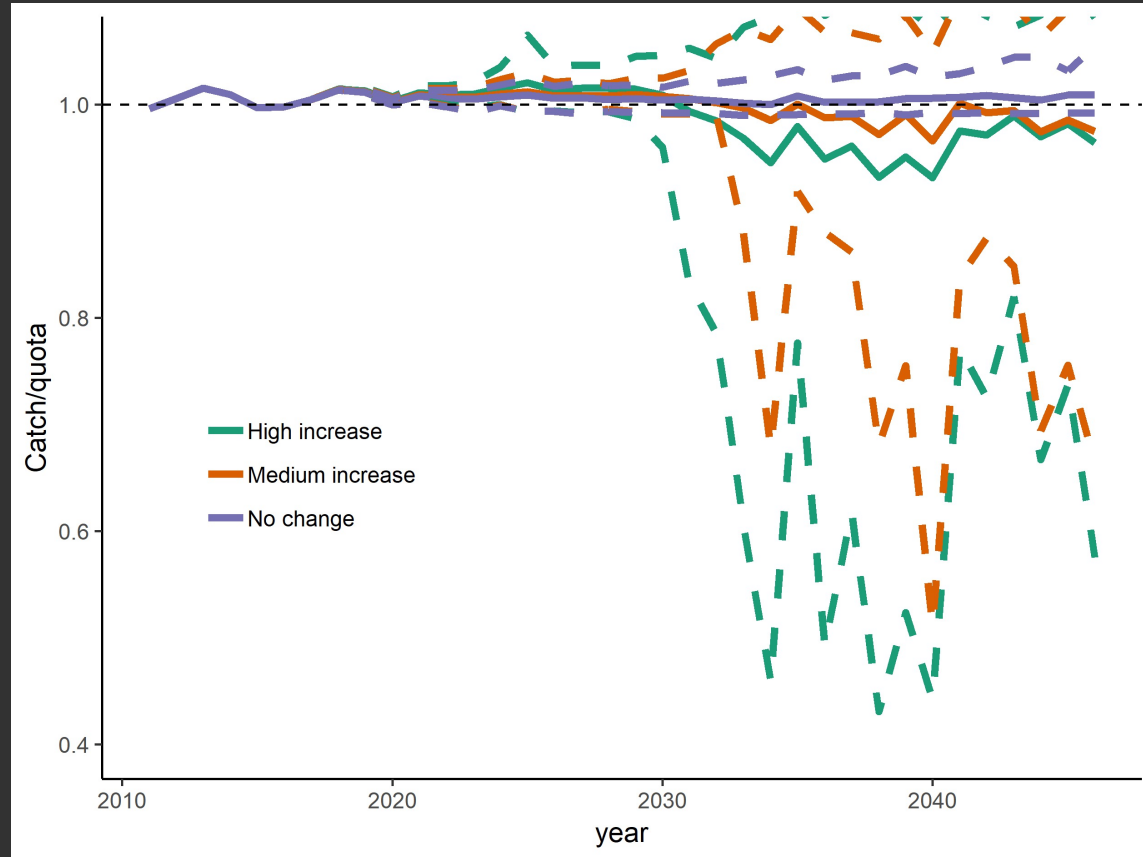# Performance metrics for climate scenarios

1) No change in movement rate

2) Moderately rate of change in movement

3) High rate of change in movement

Is the full catch potential realized?

Climate scenarios conclusions

- If climate change caused major northward distribution shifts in the stock, this could lead to more years with lower catches and closed fishery

- The US (to a lesser degree Canada) were more likely to not be able to meet their quota if climate change changes movement

- Catch variability also increased, and the US would require to increase their fishing mortality to meet their quota

Next steps and projects

- Short-term: Finish technical documentation, peer reviewed papers, and SRG review

- Future work:
  - Investigate how movement influences selectivity estimation (include time varying selectivity)
  - Time and spatially varying biological parameters

Overall conclusions

- The spatial structure has little impact on the coastwide management objectives

- If movement changes in the future it might influence movement

- Recruitment deviations are the primary drivers of uncertainty

Thank you